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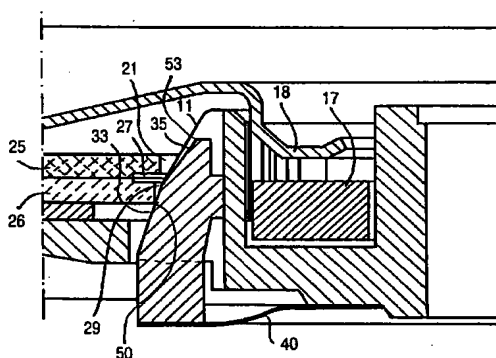
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- For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

(54) Title: **TURNTABLE FOR A DISC-SHAPED INFORMATION CARRIER AND PLAYER PROVIDED WITH SUCH A TURNTABLE**



(57) Abstract: The invention relates to a turntable (1) for a disc-shaped information carrier (2), such as a DVD, having a central round opening (21). The turntable comprises a centering element (3, 4), which is rotatable about an axis of rotation (7) by means of a driving element. The centering element (3, 4) comprises a fixed centering member (3) having a supporting surface (8) for the information carrier, and a further centering member (4) for final centering of the information carrier, said further centering member being movable in axial direction along the axis of rotation between an upper position, in which the centering member is unloaded, and a lower position, in which the centering member is loaded. An end-centering portion (32) of the movable centering member has the shape of a first truncated cone, which is directed upwards and which has a first apex angle. The turntable is further provided with a pressure member (5) for pressing the information carrier onto the support surface, as a result of which the movable centering member is moved from the upper position to the lower position. The turntable is used in a player for reading and/or writing disc-shaped information carriers having a central round opening, such as a CD or DVD player.

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Turntable for a disc-shaped information carrier and player provided with such a turntable

The invention relates to a turntable for a disc-shaped information carrier having a central round opening, comprising a centering element which is rotatable about an axis of rotation by means of a motor.

5 The invention further relates to a player for reading and/or writing a disc-shaped information carrier having a central round opening, which player is provided with a turntable for the information carrier.

10 A turntable and a player of the kinds referred to in the opening paragraphs are generally known and common. The invention is in particular intended for use with information carriers which are rotated at relatively high speeds in a player. An important exponent thereof is a DVD disc, which is rotated at 200 revolutions per second. Such high speeds reveal new problems which do not play a role at lower speeds, for example speeds of ten revolutions per second (in the case of audio CDs). An important cause of these problems  
15 is the imbalance effects that occur during rotation of the information carrier. These imbalance effects are caused by various factors. Distributed over its volume, the information carrier material exhibits an inhomogeneous density. The opening in the information carrier has certain dimensional tolerances as regards the diameter and the concentricity. Another factor  
20 is that the layers of the information carriers being built up of several disc-shaped layers, which layers are glued together, for example, are not concentrically positioned with respect to each other either. All these factors contribute to the occurrence of imbalance problems, particularly at higher rotational speeds. This leads to an unstable behavior of the information carrier, as a result of which the laser is no longer capable of following the information track on the information carrier, or even worse, causes damage to the information carrier inside the  
25 player.

It is an object of the invention to provide a turntable and a player of the kinds referred to in the opening paragraphs which exhibit a high degree of insensitivity to the imbalance effects as described above and largely caused by the inherent characteristics of the information carrier.

In order to achieve this object, a turntable according to the invention is characterized in that the centering element comprises a fixed centering member having a supporting surface for the information carrier, and a movable centering member for final centering of the information carrier which is axially movable along said axis of rotation between an upper, unloaded position and a lower, loaded position, with an end centering portion of said movable centering member being in the form of an upwardly extending, first truncated cone having a first apex angle, and in that the turntable is furthermore provided with a pressure member for pressing the information carrier onto the supporting surface, as a result of which the movable centering member moves from the unloaded position into the loaded position.

In order to achieve said object, a player according to the invention is characterized in that the turntable used therein is a turntable according to the invention.

Within the framework of the present invention, the term "unloaded position" is understood to mean that position in which no forces act on the movable centering member as a direct consequence of the presence of the disc-shaped information carrier. It is emphasized that it is not excluded that there is indeed a certain bias which acts on the movable centering member. Within the framework of the present invention, the relative concept "upper" is to be understood to refer to that side of the turntable where the pressure member is located. The concept "lower" obviously refers to the opposite side of the player. It is quite possible, however, to use a turntable according to the invention in which the turntable is positioned upside-down, or in which the axis of rotation extends horizontally. The axial movability of the axially movable centering member renders it possible to accommodate the information carrier in a correctly clamped-down position between the supporting surface and the pressure member, so that there will be no imbalance effects resulting from the centering .

The advantage mentioned above is achieved in particular in a special embodiment of a turntable according to the invention, which is provided with a supporting element by means of which the movable centering member is supported substantially without play, seen in radial direction, with respect to the fixed centering member. As a result, imbalance forces from a rotating information carrier cannot to give rise to an uncontrolled radial movement of the movable centering member towards the fixed centering member or in a direction away therefrom.

A very effective radial support as described above is obtained in another embodiment of a turntable according to the invention, in which the supporting element, seen in axial direction, is arranged in a position which substantially corresponds to a position

which the information carrier occupies on the supporting surface in use, seen in axial direction. In this embodiment, the imbalance forces from the movable centering member are transmitted directly, i.e. not by a circuitous route, in radial direction to the fixed centering member. As a result, a very stiff and stable support of the information carrier on the turntable is provided, seen in radial direction.

From a constructional point of view it is very advantageous if the supporting element is provided with a circular-cylindrical guiding surface which is present on one of the two centering members and which is concentrically positioned relative to the axis of rotation, and with a number of guide members arranged in a circle which are present on the other centering member and which abut against the aforesaid guiding surface substantially without play, seen in radial direction. As a result, it is possible to position the first cone and the second cone so as to extend one through the other, as it were.

An accurate centering is preferably obtained if the pre-centering portion of the fixed centering member has the shape of an upwardly extending second truncated cone having an apex angle which is greater than the first apex angle. The separate pre-centering and the final centering prevent an incorrect positioning of the information carrier by the turntable. In the case of an initial eccentric position, the information carrier will first slide down along the second cone of the pre-centering portion and subsequently be taken over by the first cone of the final centering portion.

In order to create a counterpressure for the pressure member and to cause the movable centering member to return from the lower, loaded position to the upper, unloaded position as soon as an information carrier is removed, the turntable is preferably provided with spring means acting between the fixed centering member and the movable centering member.

The spring means may be very suitably made up of a membrane spring, which exhibits a very rigid behavior in the plane of the membrane and which exhibits the desired elastic behavior in the direction perpendicular to the plane of the membrane.

Preferably, the membrane spring is fixedly connected only either to the fixed centering member or to the movable centering member. In the case of deflection of the membrane spring, positions on the membrane spring will tend to move in the direction of rotation. This might lead to undesirable tangential forces acting on the two centering members. This risk is excluded owing to the one-sided connection, which enables the membrane spring to move freely along one of the two centering members and/or to cause one

of the two centering members to move along with the spring as a result of the active frictional forces that occur.

According to a preferred embodiment, the movable centering member is provided with a lead portion adjacent to the upper side of the end centering portion, which lead portion is in the shape of an upwardly extending third truncated cone having a third apex angle which is greater than the second apex angle. Thus the occurrence of a horizontal edge in the upper, unloaded position of the movable centering member is prevented. An information carrier to be received on the turntable might hook behind such an edge, resulting in a slanting position of the information carrier on the turntable.

In order to achieve a proper abutment of the information carrier on the supporting surface, magnetic means are preferably provided for attracting the pressure member, which magnetic means are accommodated within the fixed centering member. This leads to a very compact construction at the same time.

An advantageous situation is obtained if the first apex angle ranges between 25 degrees and 45 degrees, or even more preferably between 30 degrees and 40 degrees. The use of such angles on the one hand prevents the information carrier exhibiting a tendency to move upwards along the end centering portion owing to imbalance effects, during operation of the turntable, whilst on the other hand a compact construction is still possible owing to the fact that the required height of the end centering portion is limited.

The invention also relates to a player for reading and writing a disc-shaped information carrier having a central round opening, which player comprises a turntable according to any one of the preceding claims. The specific advantages of such a player have already been described above with reference to the turntable. Such a player may be a DVD player, although the invention is not limited thereto.

The invention will be explained in more detail hereinafter by means of the description of a preferred embodiment, in which reference is made to the following figures.

Fig. 1 shows an assembled turntable according to the invention in longitudinal sectional view.

Fig. 2 shows the detail in the boxed part in Fig. 1.

Fig. 3A shows the fixed centering member of Fig. 1 in plan view.

Fig. 3B is a sectional view taken on the line IIIB-IIIB in Fig. 3A.

Fig. 4A shows a movable centering member in plan view.

Fig. 4B is a sectional view taken on the line IVB-IVB in Fig. 4A.

Fig. 5A shows a membrane spring in plan view.

Fig. 5B shows the membrane spring in side elevation.

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Fig. 1 shows a turntable 1 for a DVD disc 2. The turntable 1 mainly comprises a fixed centering member 3 (cf. Fig. 3A and Fig. 3B), a movable centering member 4 (cf. Fig. 4A and Fig. 4B), and a pressure member 5. The fixed centering member 3 has a central bore 6 for receiving an output shaft (not shown) of an electric motor for rotating the turntable 1 about an axis of rotation 7. On its outer side, the fixed centering member 3 is provided with an annular supporting surface 8, on which a (likewise annular) rubber friction mat 9 is arranged for transmitting a rotational movement of the turntable 1 to the DVD disc 2. The upper side of the fixed centering member 3 forms a pre-centering portion 10, within which radial ribs 24 are arranged in evenly spaced radial positions over the circumference thereof, which ribs 24 have flanks 11 on their outer sides which collectively have the shape of an upwardly extending truncated cone having an apex angle of 60 degrees. An opening 12 is present between the ribs 24 after every fourth rib 24, six openings 12 being provided in all, which openings are substantially square in shape and which define a guiding surface 19 by their inner sides. The guiding surfaces 19 are arranged on a virtual circular cylinder which is concentric with the axis of rotation 7. Three substantially tangentially extending slotted openings 14 are present in the bottom 13 of the fixed centering member 3, between the tubular wall 16 of the bore 6 and the ribs 24, which openings are evenly spaced apart in radial direction over the circumference. A magnet 17 is accommodated in the space 15 above the bottom 13 and between the ribs 24 and the wall 16, which magnet serves to attract the pressure member 5, which is for that purpose provided with a part 18 extending into the space 15.

The movable centering member 4 is a substantially made up of a ring 30 from which six arms 31 extend in upward direction, which arms are evenly spaced apart in radial direction over the circumference of the ring 30. Flanks 33 are arranged within an end centering portion 32 on the outer side of the arms 31, which arms jointly have the shape of an upwardly extending truncated cone having an apex angle of 40 degrees. At the upper side, flanks 35 merge into the flanks 33 within a lead portion 34. The flanks 35 jointly form an upwardly extending truncated cone having an apex angle of 70 degrees. Present on the inner side of the arms 31 is a supporting member, which includes a number of guide members 36

which are arranged in a circle in the illustrated embodiment and which each abut against the guiding surface 19 with a flat side 38 which faces towards the guiding surface 19 in the assembled position, substantially without play in radial direction. The movable centering member 4 is thus supported, substantially without play in radial direction, with respect to the fixed centering member 3 by means of the aforesaid supporting element. The guide members 36 extend over such a distance, seen in axial direction, and they are disposed at such a position opposite the flanks 33, seen in axial direction, that the circular (interrupted) contact edge 50 between the DVD disc 2 present on the supporting surface 8 and the flanks 33 will at all times occupy a position, seen in axial direction, which substantially corresponds to the axial position of the guide members 36 of the supporting element, provided the opening 21 of the DVD disc 2 complies with the applicable tolerance requirements.

In the assembled condition as shown in Figs. 1 and 2, the arms 31 extend through the openings 12, in which the flat sides 38 of the guide blocks 36 guidingly cooperate with guiding surfaces 19 present on the inner side of each opening 12. Seen in the direction of rotation, a limited amount of play is present between the two sides of the arms 31 and the side walls 52 of the openings 12. Owing to said guiding cooperation, the movable centering member 4 is movable in axial direction along the axis of rotation 7 with respect to the fixed centering member 3, without any play in radial direction.

A membrane spring 40, which is slightly curved in an unloaded state on account of a bias tension acting between the fixed centering member 3 and the movable centering member 4, is present at the lower side of the fixed centering member 3 and the movable centering member 4. In said unloaded state, in which a bias tension does obtain, the upper surface 39 abuts against a stop surface 51 on the lower side of the fixed centering member 3. Said bias is selected at least such that the maximum weight of the DVD disc can be absorbed. The membrane spring 40 is shown in more detail in Figs. 5A and 5B. In order to obtain the desired elasticity in axial direction, i.e. perpendicularly to the surface of the leaf spring 40, three substantially circumferentially extending slots 41 are provided in said surface. An opening 42 is centrally provided in the membrane spring 40, through which opening the driving shaft (not shown) of the driving element can extend. Present at the edge of the opening 42 are three axially extending snap elements 43 which extend through the openings 14 in the assembled position, forming a snap connection therewith so as to connect the membrane spring 40 to the fixed centering member 3. No connection is present between the lower side 37 of the ring 30 of the movable centering member 4 and the outer circumferential edge of the spring 40, as a result of which the membrane spring 40 can slide

along the bottom surface 37 upon a rotational movement of the outer circumferential edge of the membrane spring resulting from the deformation thereof, as is shown in Figs. 1 and 2, without exerting undesirable tangential forces on the fixed centering member 3 and/or the movable centering member 4.

5           The turntable as described above is used as follows. In a starting situation, in which the membrane spring 40 is as yet unloaded and only curved downward to a limited extent (on account of the bias tension) at its outer side from the lower side 20 of the bottom 13, the movable centering member 4 occupies an upper, unloaded position. The turntable 1 forms part of a player which also includes supplying means (not shown) for the DVD disc 2.

10   Said supplying means initially position the DVD disc 2 approximately concentrically above the fixed centering member 3 and the movable centering member 4, and subsequently lower it onto said centering members, as a result of which the latter will extend through the opening 21 of the DVD disc 2. Depending on the degree of eccentricity of the DVD disc 2 with respect to the centering members, the circumferential edge 22 of the DVD disc 2 will come

15   into contact with, successively, the flanks 11 and the flank 35 or only with the flank 35, and slide down along said flank or flanks. It is noted in this connection that the flank 35 extends outside the flank 11 in the unloaded position, in which position the upper outer edge 53 does not extend outside the flank 11, however. In the case of a relatively small degree of eccentricity, the DVD disc 2 will pass the flanks 11 and 35 without coming into contact

20   therewith and directly engage round the flanks 30. The dimensions of the pre-centering portion 10 have been selected such that the greatest diameter at the lower side of the pre-centering portion 10 is smaller than the smallest diameter of the opening 21 that can be expected on the basis of the required production tolerances of the DVD disc 2. The same is true with regard to the greatest diameter of the lead portion 34. Consequently, the DVD disc

25   2, starting from a "maximum" degree of eccentricity, will slide further down the flanks 11 and the flanks 35 into a position on the flanks 33. The minimum diameter of the upper side of the end centering portion 32 and the maximum diameter of the lower side of the end centering portion 32 have been selected so that they cover the full tolerance range of the opening 21 of the DVD disc 2. Thus it is ensured that the inner edge 22 of the DVD disc 2

30   will abut against the flanks 33 all around. From this position, the pressure member 5 is moved into a position above and in the immediate proximity of the DVD disc 2 by mechanical means (not shown) of the player. The pressure member 5 is pulled downwards under the influence of the force of attraction from the magnet 17, with the pressure member 5 pressing the DVD disc 2 downwards with its annular circumferential edge 23 until the disc



abuts on the friction mat 9 on the supporting surface 8. On account of the abutment of the inner edge 22 against the flanks 33, the downward movement of the DVD disc 2 is at the same time transmitted, against the spring force of the membrane spring 40, to the movable centering member 4, which will likewise move downwards in axial direction, therefore, from the upper, unloaded position to the lower, unloaded position. As was noted above, the outer edge of the membrane spring 40 will tend to perform a limited rotational movement under the influence of said downward movement. Because of the limited amount of play between the arms 31 and the openings 12 as described above, said limited rotational movement of the outer ring of the membrane spring 40 may be taken over by the movable centering member 4. From this position, the DVD disc 2 is ready for being read or being written, during which operations the DVD disc 2 is rotated about the axis of rotation 7 as a result of the fixed centering member 4 being rotated about the axis of rotation 7 by an electric motor (not shown). After completion of the reading or writing operation, the pressure member 5 is moved up, as a result of which the movable centering member 4 will move from the lower, loaded position into the upper, unloaded position under the influence of the membrane spring 40 whilst carrying along the DVD disc 2. Following that, the DVD disc 2 can be lifted by unloading means (not shown) and be removed from the player.

As Fig. 2 clearly shows, the DVD disc comprises two layers 25, 26 which are glued together. Present at the outer circumferential edge of the interface between the upper layer 25 and the lower layer 26 is a glue chamber 27. Owing to the dimensional tolerances with regard to the holes 28, 29 of the layers 25, 26, respectively, and owing to the tolerances as regards the concentricity with which the layers 25 and 26 are glued together, the outer edges of the holes 28 and 29 may well be located in different radial positions. The dimensions of the fixed centering member 3 and the movable centering member 4, and more specifically of the flanks 11 on the one hand and the flanks 33 and 35 on the other hand, have been selected such that, given the greatest possible difference in the radial positions of the inner edges of the holes 28 and 29 owing to the tolerances, it is nevertheless impossible for the DVD disc 2 to abut against one of the aforesaid flanks 11, 33 and 35 with the inner edge of the upper layer 25.

## CLAIMS:

1. A turntable for a disc-shaped information carrier having a central round opening, comprising a centering element which is rotatable about an axis of rotation by means of a driving element, characterized in that the centering element comprises a fixed centering member having a supporting surface for the information carrier, and a movable  
5 centering member for final centering of the information carrier which is axially movable along said axis of rotation between an upper, unloaded position and a lower, loaded position, with an end centering portion of said movable centering member being in the form of an upwardly extending, first truncated cone having a first apex angle, and in that the turntable is furthermore provided with a pressure member for pressing the information carrier onto the  
10 supporting surface, as a result of which the movable centering member moves from the unloaded position into the loaded position.
2. A turntable as claimed in claim 1, characterized in that the turntable is provided with a supporting element by means of which the movable centering member is  
15 supported substantially without play in radial direction with respect to the fixed centering member.
3. A turntable as claimed in claim 2, characterized in that the supporting element, seen in axial direction, is arranged in a position which substantially corresponds to a position  
20 which the information carrier occupies on the supporting surface in use, seen in axial direction.
4. A turntable as claimed in claim 2, characterized in that the supporting element is provided with a circular cylindrical guiding surface which is present on one of the two  
25 centering members and which is concentrically positioned relative to the axis of rotation, and with a number of guide members arranged in a circle which are present on the other centering member and which abut against the aforesaid guiding surface substantially without play, seen in radial direction.

5. A turntable as claimed in claim 1, characterized in that a pre-centering portion of the fixed centering member has the shape of an upwardly extending second truncated cone having a second apex angle which is greater than the first apex angle.

5 6. A turntable as claimed in claim 1, characterized in that the turntable is provided with spring means acting between the fixed centering member and the movable centering member.

7. A turntable as claimed in claim 6, characterized in that said spring means are  
10 formed by a membrane spring.

8. A turntable as claimed in claim 7, characterized in that the membrane spring is fixedly connected only either to the fixed centering member or to the movable centering member.

15 9. A turntable as claimed in claim 1, characterized in that the movable centering member is provided with a lead portion adjacent to the upper side of the end centering portion, which lead portion is in the shape of an upwardly extending third truncated cone having a third apex angle which is greater than the second apex angle.

20 10. A turntable as claimed in claim 1, characterized in that magnetic means are accommodated within the fixed centering member for attracting the pressure member.

11. A turntable as claimed in claim 1, characterized in that the first apex angle  
25 ranges between 25 degrees and 45 degrees.

12. A turntable as claimed in claim 11, characterized in that the first apex angle ranges between 30 degrees and 40 degrees.

30 13. A player for reading and writing a disc-shaped information carrier having a central round opening, which player comprises a turntable for the information carrier, characterized in that said turntable is a turntable as claimed in any one of the preceding claims.

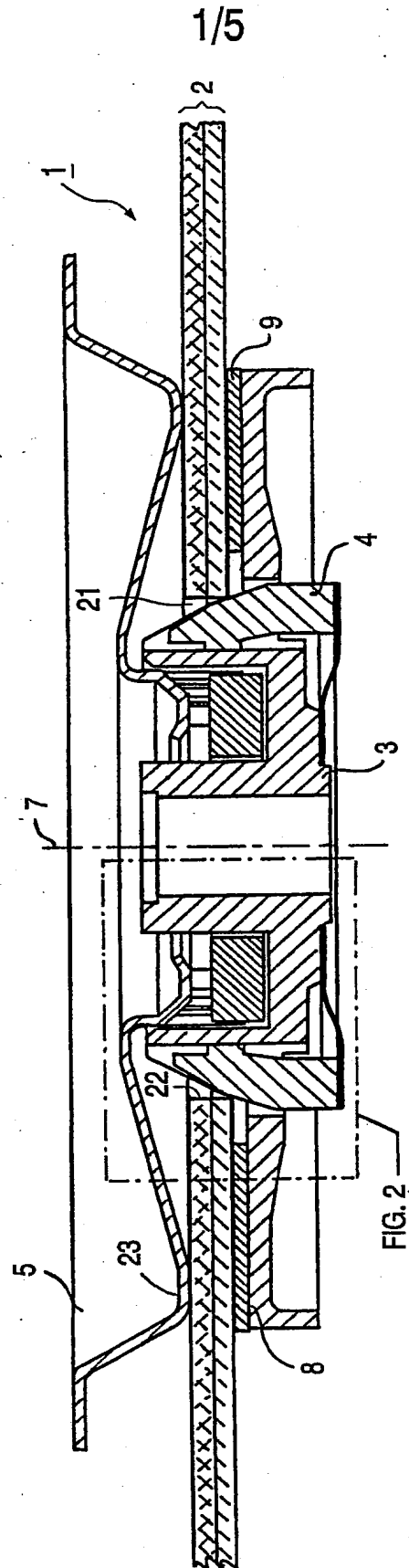


FIG. 1

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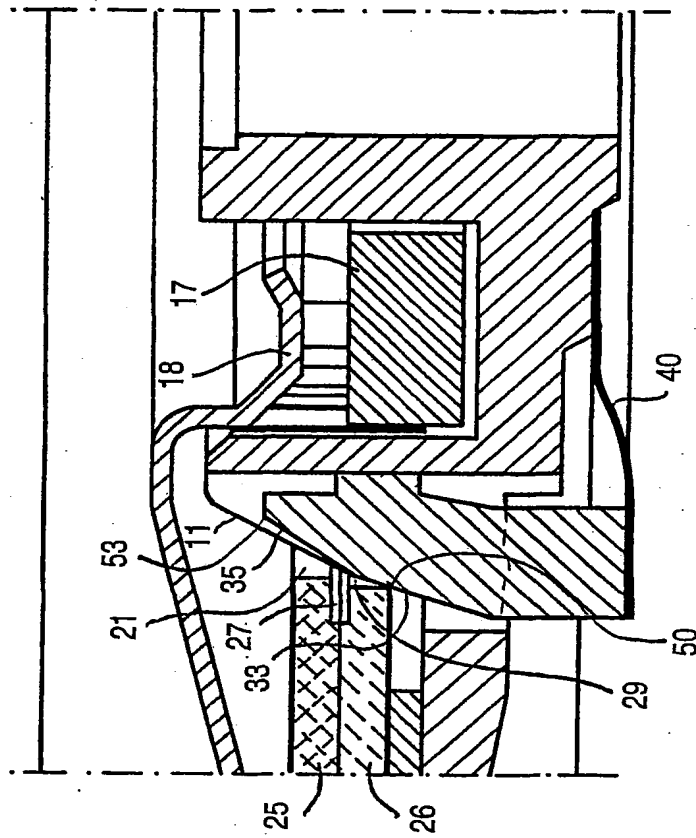
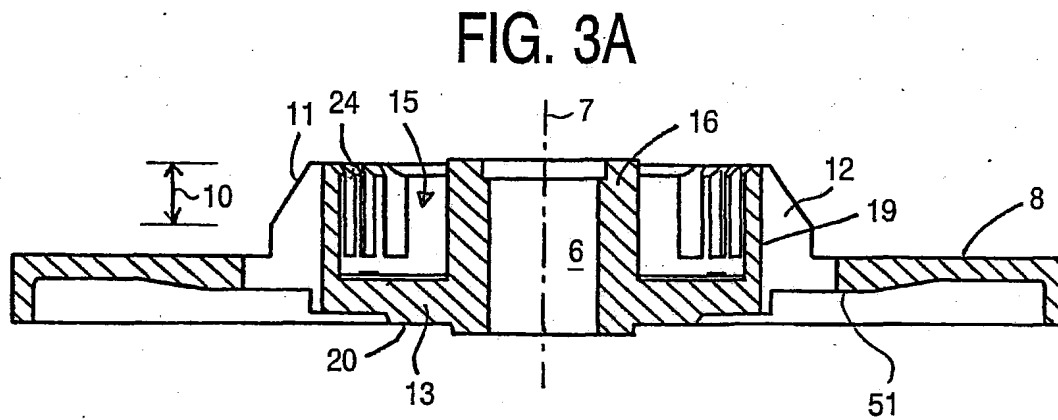
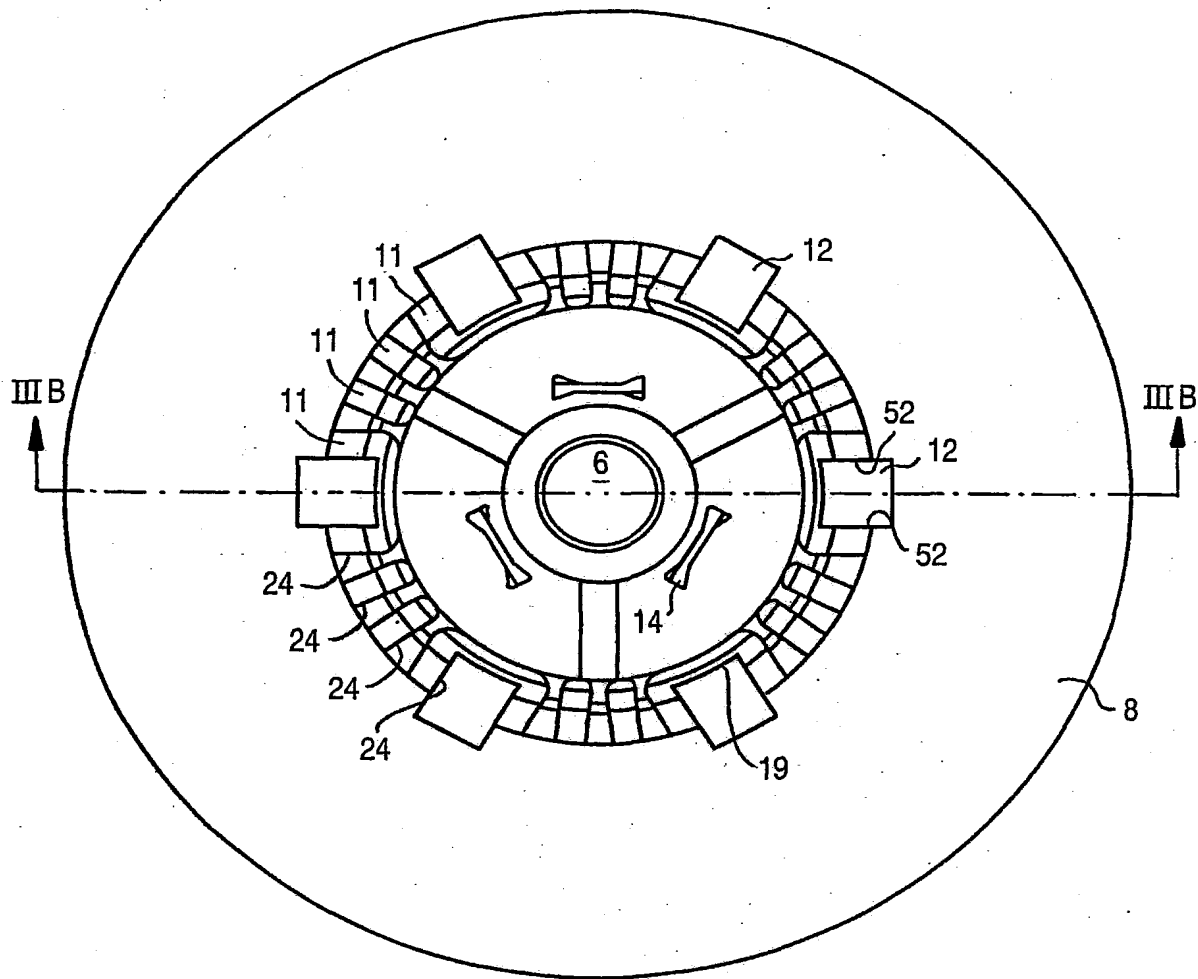


FIG. 2

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4/5

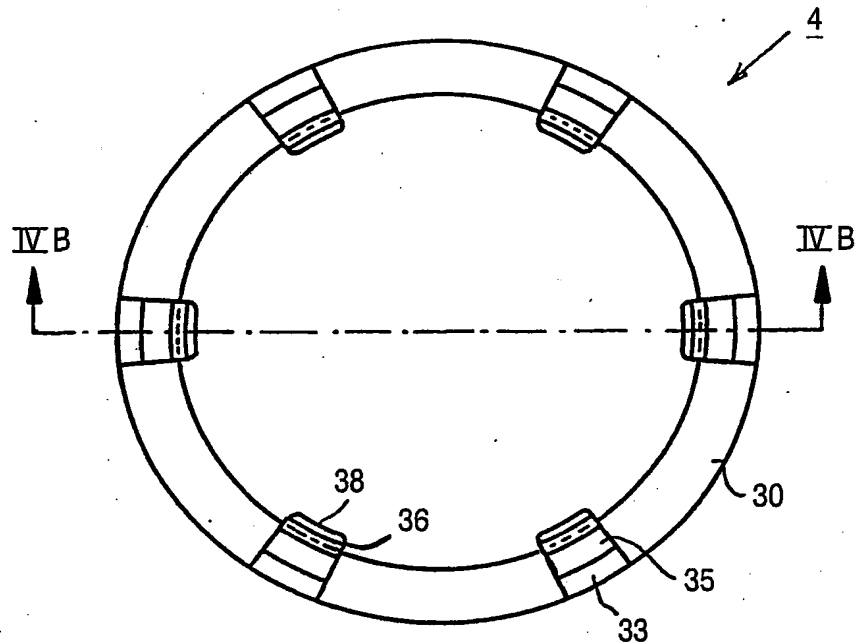


FIG. 4A

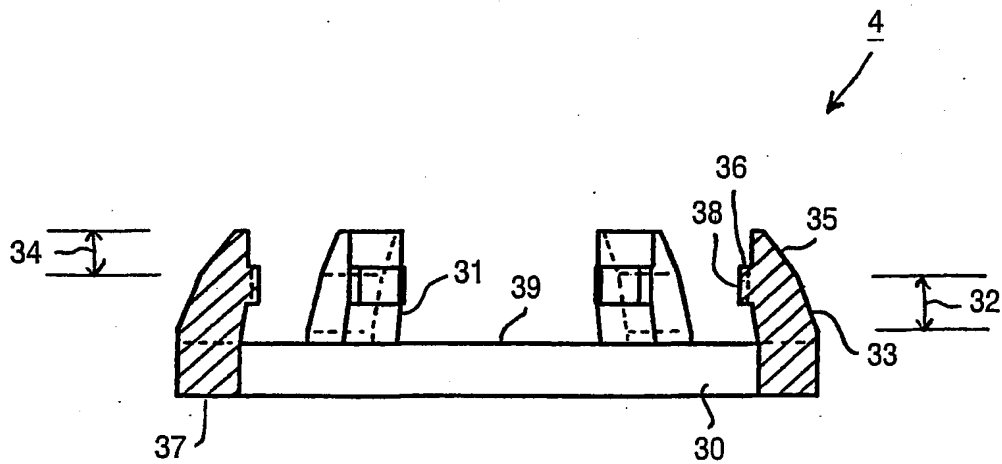


FIG. 4B

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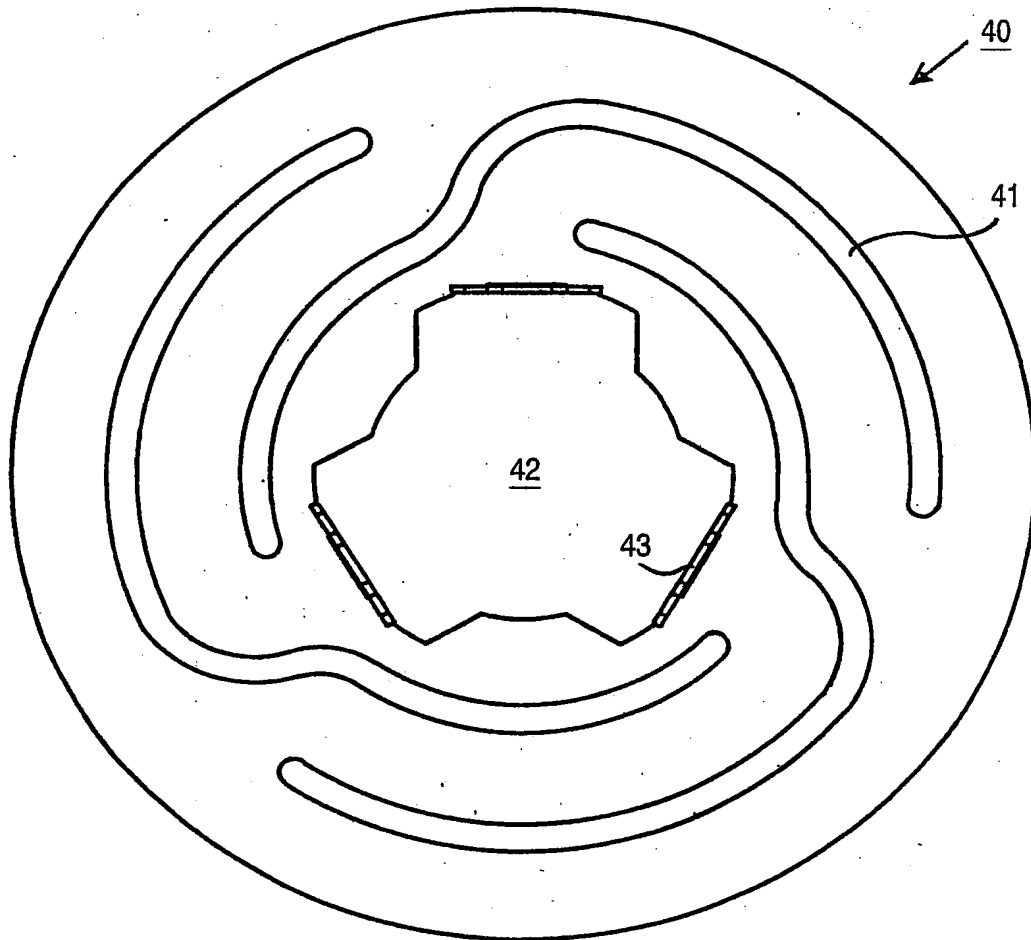


FIG. 5A

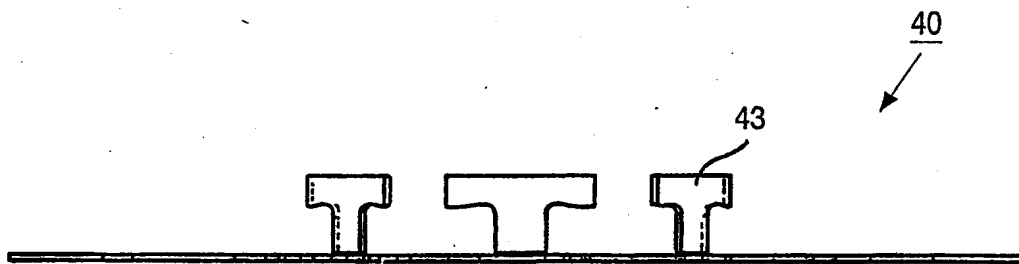


FIG. 5B



# INTERNATIONAL SEARCH REPORT

Int. Application No  
PCT/IB 02/00675

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 G11B17/028

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 G11B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, PAJ

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	GB 2 307 327 A (SAMSUNG ELECTRONICS CO LTD) 21 May 1997 (1997-05-21) page 2, paragraph 1; figure 2	1-3,5,6, 10,13 4,7-9, 11,12
X	GB 2 310 948 A (SAMSUNG ELECTRONICS CO LTD) 10 September 1997 (1997-09-10) page 1, line 30 -page 2, line 29; figure 2	1-3,5,6, 10,13
X	PATENT ABSTRACTS OF JAPAN vol. 1998, no. 13, 30 November 1998 (1998-11-30) & JP 10 208344 A (MATSUSHITA ELECTRIC IND CO LTD), 7 August 1998 (1998-08-07) figure 1 --- -/--	1-13

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

\* Special categories of cited documents:

- "A" document defining the general state of the art which is not considered to be of particular relevance
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- "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
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Date of the actual completion of the international search

22 May 2002

Date of mailing of the international search report

31/05/2002

Name and mailing address of the ISA

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Sozzi, R

# INTERNATIONAL SEARCH REPORT

Int 1al Application No  
PCT/IB 02/00675

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	<p>PATENT ABSTRACTS OF JAPAN vol. 1998, no. 08, 30 June 1998 (1998-06-30) &amp; JP 10 083602 A (NEC CORP), 31 March 1998 (1998-03-31) abstract</p> <p>-----</p>	1,13

# INTERNATIONAL SEARCH REPORT

information on patent family members

Int. ....nal Application No

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